

REMARKS

Claims 1-10 have been cancelled. New claims 11-34 have been added.

SUPPORT FOR NEW CLAIMS

Support for new claims 11-34 may be found, for example, as follows in the present specification: claim 11 (pp. 5 and 6), claim 12 (p. 5), claim 13 (p. 5), claim 14 (p. 5), claim 15 (p. 5), claim 16 (p. 6), claim 17 (p. 5), claim 18 (p. 5), claim 19 (p. 7), claim 20 (p. 10, Example 2), claim 21 (page 12, Example 3), claims 22 – 32 (same as above for respective subject matter), claims 33 – 34 (pp. 6-12).

Additionally, the term “hard fine particles” is defined both by composition (having a certain inherent, known hardness) and particle size. See page 6, lines 24-26; page 10, lines 13-14; page 11, lines 1-2; and page 12, lines 14-16. The inherent hardness may, for example, be obtained from any standard reference manual, such as the (CRC) Handbook of Chemistry and Physics, for example.

Finally, the terms “high latent heat for melting” is defined and readily understood from 1) the definition of “latent heat” (see p. 684 of the 11th Edition of Hawley’s Condensed Chemical Dictionary: “The quantity of energy in calories per gram absorbed or given off as a substance undergoes a change of state”, 2) the defined nature of the present compositions having the “high latent heat for melting”, and 3) the description at the bridging paragraph of pages 6 and 7 of the specification which provides:

...the high latent heat of the core permits a thermal deformation to occur only in the surface down to a depth of 2-3 μm , but not in the total shape. In other words, the core is not deformed, nor changed in its total shape by virtue of its high latent heat.

Thus, from all of the above, it is clear what is meant by the term “high latent heat of melting”.

Additionally, newly added claims 11-21 are directed to the mixture which is used to make the disintegrative core. Such claims are properly part of the subject matter under consideration in this case.

REQUEST FOR RECONSIDERATION

Core preparation techniques are used to prepare cast articles having complex internal structures. For example, using gravity casting, a disintegrative core made of hard sand or ceramic powder or a water-soluble salt core is positioned inside a mold, then a mold metal is introduced and solidified in the mold. Thereafter, the disintegrative core is removed such that the salt core is melted out with water or steam. Unfortunately, in high pressure casting, conventional disintegrative cores made of sand or conventional salt cores cannot be used as the mold metal penetrates into the inside of the core by cast pressure or the core is collapsed under high pressure. Although core preparation techniques have been recently proposed for use with high pressure casting, these methods suffer from the disadvantage that their application is restricted as a function of the size and shape of the cores.

Quite surprisingly, the present invention provides, in part, a method for manufacturing a disintegrative core for high pressure casting, which is capable of producing by producing a core complex shape of high pressure casting without the above noted drawbacks.

In particular, the present invention provides, a disintegrative core for high pressure casting which entails:

- (a) 70-95% by weight of fusible, water-soluble salt or salts; and
- (b) 5-30% by weight of chemically non-reactive, fine hard particles, the fine hard particles being selected from the group consisting of powders, fibers, whiskers of metals, ceramics and mixtures thereof;

wherein the mixture has a melting point in the range of from 280 to 520°C, and heat conductive coefficient (κ) in the range from 9.8×10^{-2} to $1.2 \times 10^1 \text{ W/m}^\circ\text{C}$, and which has a higher latent heat for melting, and said fusible, water-soluble salt or salts is selected from the group consisting of CuCl, PbCl_2 , a mixture of NaCl (82% by weight) and CuCl (18% by weight), a mixture of KNO_3 (92% by weight), and KCl (8% by weight), a mixture of KCl (54% by weight) and LiCl (46% by weight), a mixture of MgCl_2 (54% by weight) and NaCl (46% by weight), a mixture of CaCl_2 (53% by weight) and BaCl_2 (47% by weight) and a mixture of NaCl (54% by

weight) and CaCl_2 (46% by weight).

The present invention also provides a mixture for preparing a disintegrative core, and a disintegrative core, itself.

Claims 1-4 and 6-10 stand rejected under 35 USC 103 (a) as being unpatentable over Foreman US 4,840,219 in view of Foreman et al., US 4,904,423.

However, neither of these references, either alone or in combination, describes or suggests the present invention.

At the outset, it is noted that the salts used in accordance with the present invention which are used to prepare a cast and core, have a melting point in the range of from 280 to 520° C with a heat conductive coefficient (κ) in the range of from 9.8×10^{-2} to $1.2 \times 10^1 \text{ W/m}^\circ\text{C}$, with a high latent heat for melting as defined in the present specification. Thereby, the core made of such salts can be used to cast aluminum or magnesium alloys having higher melting points than the salts within a relatively short time (such as 0.5 to 3 seconds) without being deformed. Thereafter, the core can be removed from cast article by melting the core and then reusing the core.

In contrast, US 4,840,219 merely describes the fabrication of casting cores from a mixture containing a molten salt having dispersed therein a particulate material which includes a first refractory material having a mesh size of 60-120, and a second refractory material having a mesh size of at least 200.

However, it is quite clear that this reference fails to either disclose or suggest the particular fusible, water-soluble salt or salts of the present invention. Notably, as noted above these particular salts have a melting point in the range of from 280 to 520° C with a heat conductive coefficient in the range of from 9.8×10^{-2} to $1.2 \times 10^1 \text{ W/m}^\circ\text{C}$.

As noted above, using these particular salts, it is now possible to cast aluminum or magnesium alloys having higher melting points than such salts within a relatively short time without being deformed.

Thereafter, the core can be removed from the casted article by melting the core, and the salts retrieved can be easily reused.

Thus the fusible, water-soluble salts of the present invention are used specifically in view of the problem addressed by the present invention. Namely, this problem pertains to the rapid casting of aluminum or magnesium alloys using cores made of the fusible, water-soluble salts such that the cores can be easily removed from the casted article by melting the core. The salts thus retrieved can be easily recycled for reuse.

In contrast, U.S. 4,840,219, describes difference mixtures, such as sodium chloride, sodium carbonate, and alumina of varying mesh size. See Examples 1-6 at columns 7 and 8. Furthermore, this reference describes the necessary use of much higher salt melting temperatures than the present invention. Notably, at col. 3, lines 43-45, the following language is recited:

In these instances where the cores are to be employed in an aluminum casting process it is generally preferred that the salt has a melting point in excess of 1225°F.

In contrast, the salts of the present invention have an upper limit on melting point of 520°C or 968°F. Thus, the reference teaches the use of melting points which are more than 250°F higher than the present invention. Clearly, one skilled in the art would have no motivation to use the lower melting point salts of the present invention.

US 4,904,423 merely describes a process for pressure molding an article around a hardened core made from a mixture of relatively low melting temperature salts and sands.

However, this reference also fails to either disclose or suggest the particular water-soluble salt or salts of the present invention as well as the particular range of melting temperatures and heat conductive coefficients.

In particular, this reference teaches the use of a core made of a mixture of salt and sand or other inert material. The salts are described at col. 6, line 65 to col. 4, line 25. The preferred salts are described as:

...a mixture comprising alkali metal nitrates and/or
nitrites such as sodium and potassium nitrates and
nitrites, optionally with one or more alkali metal chlorides.

Quite clearly, one skilled in the art would be neither motivated nor enabled even with the combined teachings of these references to attain the present invention.

Hence, this ground of rejection is believed to be unsustainable and should be withdrawn.

Claim 5 stands rejected under 35 USC 103 (a) as being unpatentable over US 4,840,219 in view of US 4,904,423 and further in view of Nagata et al.

However, Nagata et al. has merely been cited as teaching the use of a graphite mold for the purpose of effectively forming and removing a sintered salt from the mold. However, it is quite clear that Nagata et al. fails to correct the deficiencies of the former two cited references. As such, it is not seen how one skilled in the art would be motivated from the additional teachings of Nagata et al. to make and use the present invention.

Hence, this ground of rejection is believed to be unsustainable and should be withdrawn.

Claims 1-10 stand rejected under 35 USC 112, second paragraph.

In view of the above amendments, however, it is believed that this ground of rejection is now moot.

Accordingly, in view of all of the above, it is believed that the present application now stands in condition for allowance. Early notice to this effect is earnestly solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP



William E. Beaumont
Registration No. 30,996

1700 Diagonal Road, Suite 300
Alexandria, Virginia 22314
(703) 684-1111
(703) 518-5499 Facsimile
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WEB/etp

stimulated emission. Such beams have extremely high energy as they consist of a single wavelength and frequency. Materials capable of producing this effect are certain high-purity crystals (ruby, yttrium garnet, and metallic tungstates or molybdates doped with rare-earth ions); semiconductors such as gallium arsenide, neodymium-doped glass; various gases, including carbon dioxide, helium, argon, and neon; and plasmas. A chemical laser is one in which the excitation energy is furnished by a chemical reaction, e.g., $H + Cl_2 \rightarrow HCl \text{ (active)} + Cl$; or combustion of carbon monoxide to form excited carbon dioxide.

Hazard: Laser radiation can irreparably damage the eyes. Proper shielding is essential at all times.

Use: Laser beams are used in industry for cutting diamonds for wire-drawing dies, in flash photolysis, spectroscopy, and photography. They also have developing applications in medicine and surgery. They are being used for controlled fusion reactions, for biomedical investigations, for organic chemical research, for sophisticated analytical techniques, and in three-dimensional photography (holography). It is possible to increase the abundance of certain isotopes of such elements as uranium, chlorine, and boron by use of laser irradiation. Research on uranium enrichment by this method has been under way for several years.

See also fusion (2), enrichment, holography.

LATB. See lithium aluminum tri-tert-butoxyhydride.

latent heat. The quantity of energy in calories per gram absorbed or given off as a substance undergoes a change of state, that is, as it changes from liquid to solid (freezes), from solid to liquid (melts), from liquid to vapor (boils), or from vapor to liquid (condenses). No change in temperature occurs. Water has unusually high latent heat values; the latent heat of fusion (melting) of ice is 80 cal/g and the latent heat of condensation of steam (latent heat of vaporization of water) is 540 cal/g. The considerable energy delivered by steam condensation is utilized for power generation and for heating a variety of chemical plant equipment (dryers, evaporators, reactors and distillation columns).

See also evaporation; heat.

latent solvent. See solvent, latent.

latrite. A low-grade ore similar to bauxite, but containing only half as much aluminum oxide. Possible substitute for bauxite.

latex. A white, tacky, aqueous suspension of a hydrocarbon polymer occurring naturally in some species of trees, shrubs, or plants, or made

synthetically. the most important natural latex is that of the tropical tree *Hevea brasiliensis*, which was the only source of rubber up to 1945. It is comprised of globules of rubber hydrocarbon coated with protein; the particles are of irregular shape, varying from 0.5–3 microns in diameter; the suspension is stabilized by electric charges. The composition is about 60% water, 35% hydrocarbon, 2% protein, and low percentages of sugars and inorganic salts. For commercial purposes, rubber latex can be concentrated by evaporation or centrifugation. Ammonia is added as a preservative. Coagulation is induced by addition of acetic or formic acid. A vulcanized form is available. Natural latex is used in the manufacture of thin articles (surgeons' gloves and other medical equipment), as an adhesive, in foamed products and for coating various products such as tire cord. Conversion of latex to gasoline via zeolite catalysts has been reported.

Other sources of rubber-containing latex are guayule, a shrub grown in Mexico and the southwestern US, and several types of dandelions and related species. The botanical function of latex in the plant is unknown.

Synthetic latexes are made by emulsion polymerization techniques from styrene-butadiene copolymer, acrylate resins, polyvinyl acetate, and similar materials. Their particle size is much smaller than in natural latex, ranging from 0.05–0.15 micron; thus, they are truly colloidal suspensions. Their chief use is as a binder in exterior and interior paints, replacing drying oils; they are also used for foams and coatings.

See also guayule, gutta percha, electrophoresis, paint, emulsion, "Vultex."

latex paint. See paint, emulsion.

"Lanthanol" LAL²⁴⁰ TM for a highly refined sodium "lauryl" sulfoacetate, biodegradable organic detergent possessing wetting, scouring, emulsifying, and dispersing properties; a foaming agent.

Properties: White dry powder, pH 6.9–7.1 in 0.25% water soluble, stable to hard water, stable to acid and alkali in a pH range of 5.0–8.5, soluble in water solution 1% at 25°C, 25% at 100°C, hygroscopic, d 0.55, pleasant odor, tasteless.

Use: Tooth pastes, tooth powders, liquid dentrifices, foaming bath salts, shampoos, synthetic detergents.

"Latifcrete."⁷⁰⁸ TM for a series of latex admixtures designed to replace the water in Portland cement mortars, providing tremendous improvement to many of the key physical properties, i.e., adhesion, shock resistance, frost resistance, etc.